

COMPARISON OF TWO TECHNIQUES OF FIGURE OF EIGHT TENSION BAND WIRING ON BIOMECHANICAL STABILITY OF PATELLAR FRACTURE

Despina Ciocanel M.D.^{1,2}, Steve Haman M.D.², Richard Yeasting Ph.D.²,
Vijay Goel Ph.D.^{1,3} and Nabil Ebraheim M.D.²

Spine Research Center¹, Medical College of Ohio² and University of Toledo³, Toledo, Ohio
E-mail: dciocanel@mco.edu

INTRODUCTION

Transverse fractures of patella are a common orthopedic problem with a relatively high rate of nonunion. This study aims to illustrate possible improvements in surgical technique, which may result in higher rate of fracture healing.

The objective is to compare biomechanical stability of two different techniques of patellar fixation using an established cadaveric model. Specifically, our research aims to study the effect of distance from the patellar poles of the tension band in the classic figure of eight construct on the separation at the fracture site in response to external loads applied through the tendon.

METHODS

Five pairs of embalmed knees (mean age 77.4 years, SD 10.15 years) were dissected, and transverse patella fractures were simulated. The knees were reduced and fixed with two distinct techniques. Both techniques employed the classic parallel k-wires and figure of eight tension band construct. In one group (left femurs), the tension band was placed at a distance of 1.0 cm from the proximal and distal pole of the patella (Fig. 1.a). In the other group (right femurs), the tension band was placed directly adjacent to the patellar poles (Fig.1.b). The knees were fixed by two parallel 2.3 mm Kirschner wires with a

1.0 millimeter / Synthes titanium Cable with Crimp.

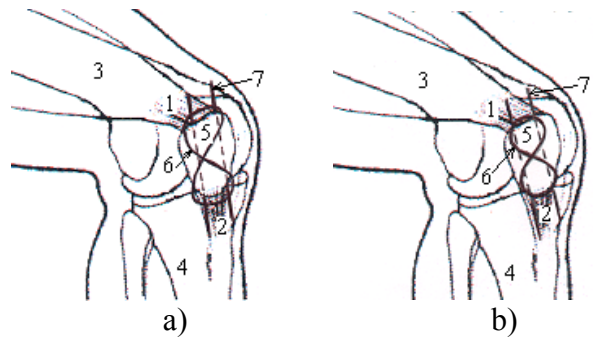


Figure 1: Schematic of patella tension band with figure of eight. 1–quadriceps tendon, 2–patellar tendon, 3–femur, 4–tibia, 5–patella, 6–tension band, 7–Kirschner wires.

Knees were tested by applying a cyclic load through the quadriceps tendon between 20 and 300 N for 30 cycles.



Figure 2: Specimen setup, showing the extensometer placement and the cable-and-pulley system assembly used to apply load to quadriceps tendon.

Force was applied to the quadriceps tendon through a cable-and-pulley system (Fig.2) and measured using an MTS load cell (1,000 Newton range). A mechanical extensometer was placed on the anterior surface, spanning the fracture to record the separation across the fracture site (Fig.2).

RESULTS AND DISCUSSION

The maximum fracture displacement increased with each cycle of loading for both techniques. (Fig. 3)

The average displacement at the thirtieth cycle was 1.078 millimeters (SD 0.82 mm) for patella tension band construct on the patella poles and 2.368 millimeters (SD 1.41 mm) for tension band construct 1 cm off the patellar poles.

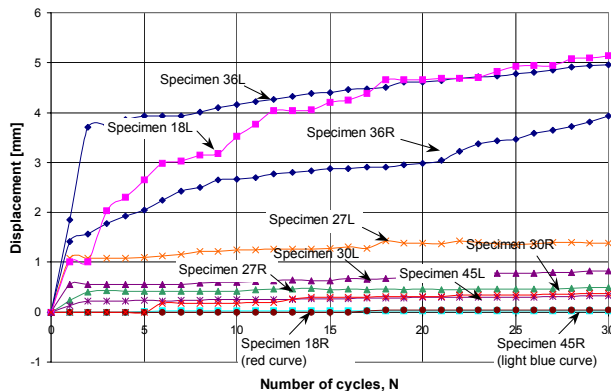


Figure 3: the maximum displacement (separation across fracture line) recorded during each cycle of loading for 10 specimens.

When comparing both methods for all cycles, the tension band placed on patellar poles allowed less fracture displacement than the tension band placed 1-cm off the patellar poles.

Fixations of transverse patellar fracture with figure of eight tension band have long been described. The position of the tension band

in relation to the pole of the patella has not been biomechanically evaluated. We have demonstrated the importance of position of the tension band with relation to the pole of the patella. Soft tissue impingement between the pole of the patella and tension band is detrimental to maintenance of the reduction of the fracture.

SUMMARY

The effect of changing the distance from the patellar poles of the tension band with the figure of eight on the separation across the fracture was studied.

Comparing both methods for all cycles, the tension band placed on patellar poles allows lesser fracture displacement than the other tension band configuration. Thus, the placement of the tension band on both patellar poles may result in higher rate of fracture healing.

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